

# Previous reproductive history and post-natal family planning among HIV-infected women in Ukraine<sup>†</sup>

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**BACKGROUND:** Ukraine has the highest antenatal HIV prevalence in Europe. The national prevention of mother-to-child transmission (MTCT) programme has reduced the MTCT rate, but less attention has been given to the prevention of unintended pregnancy among HIV-positive women. Our objectives were to describe the reproductive health, condom use and family planning (FP) practices of HIV-positive childbearing Ukrainian women and to identify factors associated with different methods of post-natal contraception.

**METHODS:** HIV-infected childbearing women, diagnosed before or during pregnancy, were enrolled prospectively in a post-natal cohort study in four regional HIV/AIDS centres in Ukraine from December 2007. Logistic regression models were used to identify factors associated with post-natal FP practices.

**RESULTS:** Data were available for 371 women enrolled by March 2009; 82% ( $n = 303$ ) were married or cohabiting, 27% (97 of 363) reported a current HIV-negative sexual partner and 69% were diagnosed with HIV during their most recent pregnancy. Overall, 21% (75 of 349) of women were not using contraception post-natally (of whom 80% reported no current sexual activity), 50% (174 of 349) used condoms, 20% (74 of 349) relied solely/partially on coitus interruptus and 4% used hormonal methods or intrauterine device. Among married/cohabiting women, consistent use of condoms in the previous pregnancy [AOR 1.96 (95%CI 1.06–3.62)], having an HIV-positive partner [AOR 0.42 (0.20–0.87)], current sexual activity [AOR 4.53 (1.19–17.3)] and study site were significantly associated with post-natal condom use; 16% of those with HIV-negative partners did not use condoms. Risk factors for non-use of FP were lack of affordability [AOR 6.34 (1.73–23.2)] and inconsistent use of condoms in the previous pregnancy [AOR 7.25 (1.41–37.2)].

**CONCLUSIONS:** More than 40% of HIV-positive women in this population are at risk of unintended pregnancy and the one in six women in HIV-discordant couples not using barrier methods risk transmitting HIV to their partners. Our study results are limited by the observational nature of the data and the potential for both measured and unmeasured confounding.

**Key words:** HIV / family planning / condom / prevention / mother-to-child transmission of HIV

## Introduction

The HIV epidemic in Ukraine is the fastest growing in Europe, with 1.63% of the population estimated to be HIV positive (UNAIDS, 2008; Kruglov *et al.*, 2008). An increasing proportion of adults with HIV-infection are female, estimated at 45% in 2007 (Kruglov *et al.*, 2008), the vast majority of whom will be of childbearing age. Recent data indicate that Ukraine also has the highest prevalence of HIV-

positive pregnant women in Europe, at 0.52% (UNAIDS, 2008). Although the HIV epidemic in Ukraine has been driven by injecting drug use (IDU), most pregnant HIV-infected women do not have a IDU history themselves, although many (up to a third) have sexual partners who have injected drugs (Malyuta *et al.*, 2006; European Collaborative Study, 2006).

Women of childbearing age, with and without HIV infection, are at the centre of the UN Strategic Approach to the Prevention of

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Mother-to-Child Transmission of HIV (PMTCT) (Interagency Task Team on Prevention of HIV infection in pregnant women, 2007). With application of the four PMTCT 'pillars' (primary prevention, prevention of unintended pregnancies among HIV-infected women, PMTCT and providing care, treatment and support to HIV-positive women and their children), it is hoped that the public health goal of virtual elimination of HIV infection in infants (reducing MTCT to <2%) in Europe by 2010 is within reach (Ostergren and Malyuta, 2006; Matic *et al.*, 2008). Substantial progress has been made in reducing MTCT rates in Ukraine (Thorne *et al.*, 2009). However, little is known about rates of unintended pregnancy and choice of contraception among HIV-infected women in Ukraine. Some Western European studies have indicated that around half (51–58%) of pregnancies among HIV-infected women are unintended (Fiore *et al.*, 2006; Florida *et al.*, 2007), whereas in one Russian survey of HIV-positive women, 54% of those who had recently completed their pregnancy reported not having planned their pregnancy (Vartapetova *et al.*, 2006).

Unintended pregnancy among HIV-infected women in Ukraine may elevate risk of both MTCT and infant abandonment, particularly by marginalized women (e.g. injection drug users, illegal migrants) (Rutenberg and Baek, 2005). Condom use within partnerships including HIV-infected women is important regardless of the infection status of their partners due to risk of onward transmission to HIV-negative partners and the risk of super-infection (Gottlieb *et al.*, 2004; Campbell *et al.*, 2009) within HIV concordant partnerships. Condom use also prevents infection with other sexually transmitted infections (STIs), some of which may hasten HIV disease progression and increase MTCT risk (Mwapasa *et al.*, 2006; Corey, 2007; Cowan *et al.*, 2008; Sheth *et al.*, 2008; Thorne *et al.*, 2008).

The Ukraine National Reproductive Health program states that free contraception should be provided to all HIV-infected women, consistent with UNFPA and WHO guidelines (UNFPA and World Health Organization, 2006). Little information is currently available regarding FP and condom use in HIV-infected women in Ukraine or elsewhere in Eastern Europe. Our objectives were to describe the reproductive health, condom use and FP practices of HIV-positive childbearing Ukrainian women and to identify factors associated with condom use in pregnancy and different methods of post-natal contraception, within the context of this current policy.

## Methods

The Ukrainian Post-natal Cohort Study of HIV-infected Childbearing Women was established in December 2007 to follow-up the HIV disease progression and socio-demographic characteristics of HIV-infected childbearing women in Ukraine. The study is a nested sub-study of the European Collaborative Study (ECS) in Ukraine that have been enrolling mother-child pairs since 2000. The ECS is a birth cohort study addressing MTCT and its prevention and HIV infection in pregnancy and childhood, involving enrolment of pregnant HIV-infected women, with longitudinal follow-up of their infants (European Collaborative Study, 2006; Thorne *et al.*, 2009).

Four regional HIV/AIDS centres in Ukraine participate in the post-natal women's cohort study: odesa, Kiev, Krivoy Rog and Donetsk. Eligibility criteria for enrolment were HIV-positive status (diagnosed before or during recent pregnancy or through intrapartum testing) and recent delivery. The protocol involves collection of baseline data (usually 3–6 months post-partum), through two standardized questionnaires, one completed

by the woman and the other by her physician. Follow-up clinical information is being collected bi-annually, but is not addressed in this paper. All data were anonymously coded. Self-reported variables on demographic and lifestyle factors (including age, marital status and education), health behaviours (including condom and other contraception use, affordability of contraception, current smoking, illicit drug use) and HIV-specific factors (disclosure of HIV status to partner, partner's HIV status) were collected in the women's questionnaire. The clinical forms collected data on hepatitis C coinfection and STIs diagnosed during the most recent pregnancy or post-natally, markers of HIV disease progression and antiretroviral treatment. The majority (83%) of women had been enrolled and followed in the ECS while pregnant, allowing linkage to ECS pregnancy data.

## Definitions

Consistent condom use in pregnancy was defined as condom use reported 'most' or 'all of the time' versus 'never' or 'some of the time'. Effective contraceptive methods for the purposes of our analyses were defined as the oral contraceptive pill (OCP), injectable hormone and intrauterine device (IUD). Women reporting no use of the following were considered to be using no post-natal contraception: condoms, *coitus interruptus*, OCP, IUD, or injectable hormones.

## Statistical analysis

Univariable comparisons were assessed with the  $\chi^2$  test for categorical variables. Logistic regression models were fitted to obtain odds ratios (OR) and 95% confidence intervals (95% CI) and were used to identify factors associated with consistent condom use in pregnancy and contraception use post-natally. Candidate explanatory variables not associated with outcome variables in univariable models ( $P > 0.10$ ) were not considered in further analyses. Some explanatory variables were classified into categories as follows: age (classified as  $\leq 24$ , 25–29 or  $\geq 30$  years), education (left school  $\leq 18$  or  $> 18$  years of age), bacterial STI (positive test for Chlamydia, gonorrhoea or syphilis versus negative tests), HIV-positive partner (no, yes, do not know/no current partner), timing of HIV diagnosis (before this pregnancy versus during pregnancy or intrapartum). The logistic models of factors associated with post-natal use of contraception were limited to married or cohabiting women; only 10 single, divorced or widowed women reported being sexually active at the time of enrolment.

Data were managed in an Access 2002 database (Microsoft Corps, Redmond, WA, USA) and statistical analyses were performed with SAS (v8.02, SAS Institute, USA).

## Results

### Cohort characteristics

By March 2009, a total of 371 women had been enrolled, at a median of 4 months post-partum (IQR = 2–15). Nearly, all were white and born in Ukraine (327 of 330, 99%). Approximately one quarter of women had a history of IDU or had a previous or current partner who was an IDU; further demographic and health information is shown in Table 1. Most women had only ever had mild symptoms of HIV disease (WHO clinical stage I); most had CD4 counts  $> 350$  cells/mm<sup>3</sup> and thus few women were currently on highly active antiretroviral therapy (HAART) (Table 1). Around one in four women had at least one coinfection, the most common being Hepatitis C virus (HCV) and Herpes simplex virus-2 (HSV-2) (Table 1). Just over a quarter of women had an HIV-negative sexual partner at the time of enrolment (27%, 97 of 363), 40% ( $n = 145$ ) had an

**Table 1** Demographic and health characteristics of the study population.

| Characteristic                       | N   | n (%) or median (range) |
|--------------------------------------|-----|-------------------------|
| Socio-demographic                    |     |                         |
| Age (years)                          | 368 | 27 (16-42)              |
| Age left education (years)           | 196 | 20 (14-27)              |
| Marital status                       | 368 |                         |
| Cohabiting                           |     | 90 (24.5)               |
| Divorced                             |     | 16 (4.3)                |
| Married                              |     | 213 (57.9)              |
| Single                               |     | 46 (12.5)               |
| Widowed                              |     | 3 (0.8)                 |
| Coinfections                         |     |                         |
| Herpes simplex virus-2               | 293 | 75 (25.6)               |
| Chlamydia                            | 307 | 42 (13.7)               |
| Syphilis                             | 318 | 6 (1.9)                 |
| Human papilloma virus                | 109 |                         |
| Low-grade lesions                    |     | 8 (7.3)                 |
| High-grade lesions                   |     | 8 (7.3)                 |
| Hepatitis-C seropositive             | 286 | 81 (28.3)               |
| HIV-related                          |     |                         |
| History of injection drug use (IDU)  | 303 | 84 (27.7)               |
| Current/former sexual partner an IDU | 301 | 71 (23.6)               |
| Timing of HIV diagnosis              | 331 |                         |
| Pre-pregnancy                        |     | 102 (30.8)              |
| Antenatal/intrapartum                |     | 229 (69.2)              |
| CD4 count (mm <sup>3</sup> )         | 311 | 435 (2–1267)            |
| WHO clinical stage                   | 355 |                         |
| I                                    |     | 270 (76.1)              |
| II                                   |     | 14 (3.9)                |
| III                                  |     | 62 (17.5)               |
| IV                                   |     | 9 (2.5)                 |
| Currently receiving HAART            | 371 | 52 (14.0)               |

HIV-positive partner and the remaining third ( $n = 121$ ) either did not know their partner's status or had no current partner. Forty percent of married or cohabiting women who knew their partners' HIV status were in an HIV-discordant partnership (i.e. had a negative partner) (94 of 232). The pregnancy history of participants in terms of previous live/stillbirths, terminations and miscarriages prior to their most recent pregnancy is illustrated in Fig. 1. Nearly a third of women had a history of pregnancy termination, although 38% had never been pregnant before. Most (77%, 282 of 365) women had planned their most recent pregnancy.

### Condom use in most recent pregnancy

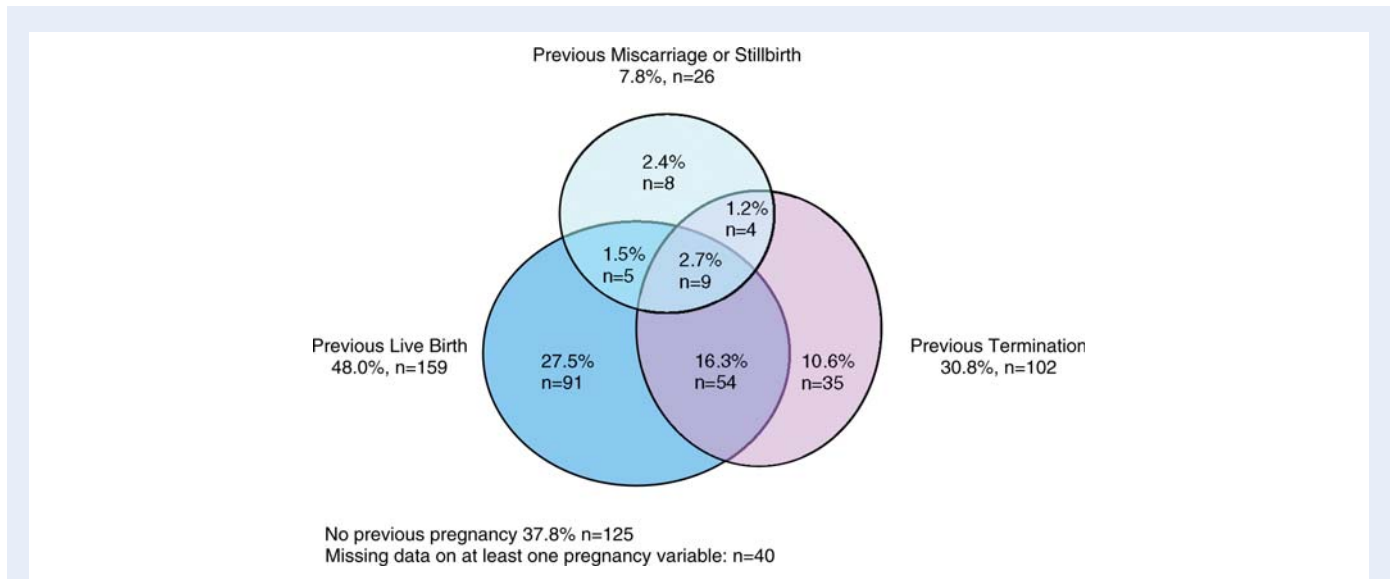
Condom use in pregnancy was investigated according to timing of maternal HIV diagnosis. Among 138 women known to be aware of their HIV status before pregnancy or diagnosed in the first trimester of pregnancy, 22% ( $n = 31$ ) never used condoms in pregnancy and

35% ( $n = 48$ ) used condoms consistently; 55% (16 of 29) of women with HIV-negative partners used condoms consistently compared with 34% (19 of 56) of those with HIV-positive partners and 26% (13 of 50) of those with partners of unknown status ( $\chi^2 = 6.9$ ,  $P = 0.03$ ). Women with HIV-negative partners were 3.5 times more likely to use condoms consistently than women with partners of unknown HIV status (OR 3.50 95% CI 1.33–9.21,  $P = 0.011$ ) and 2.4 times more likely to do so than women with HIV-positive partners, with borderline significance (OR 2.40 95% CI 0.96–6.00,  $P = 0.062$ ). Among women diagnosed with HIV after the first trimester of pregnancy, 18% (31 of 173) never used condoms during pregnancy, with identical proportions found in women diagnosed in the second trimester (18%, 24 of 135) and third trimester/intrapartum (18% 7 of 38). The HIV status of the woman's partner was not associated with never/ever use of condoms in pregnancy among women diagnosed after the first trimester ( $P = 0.08$ ).

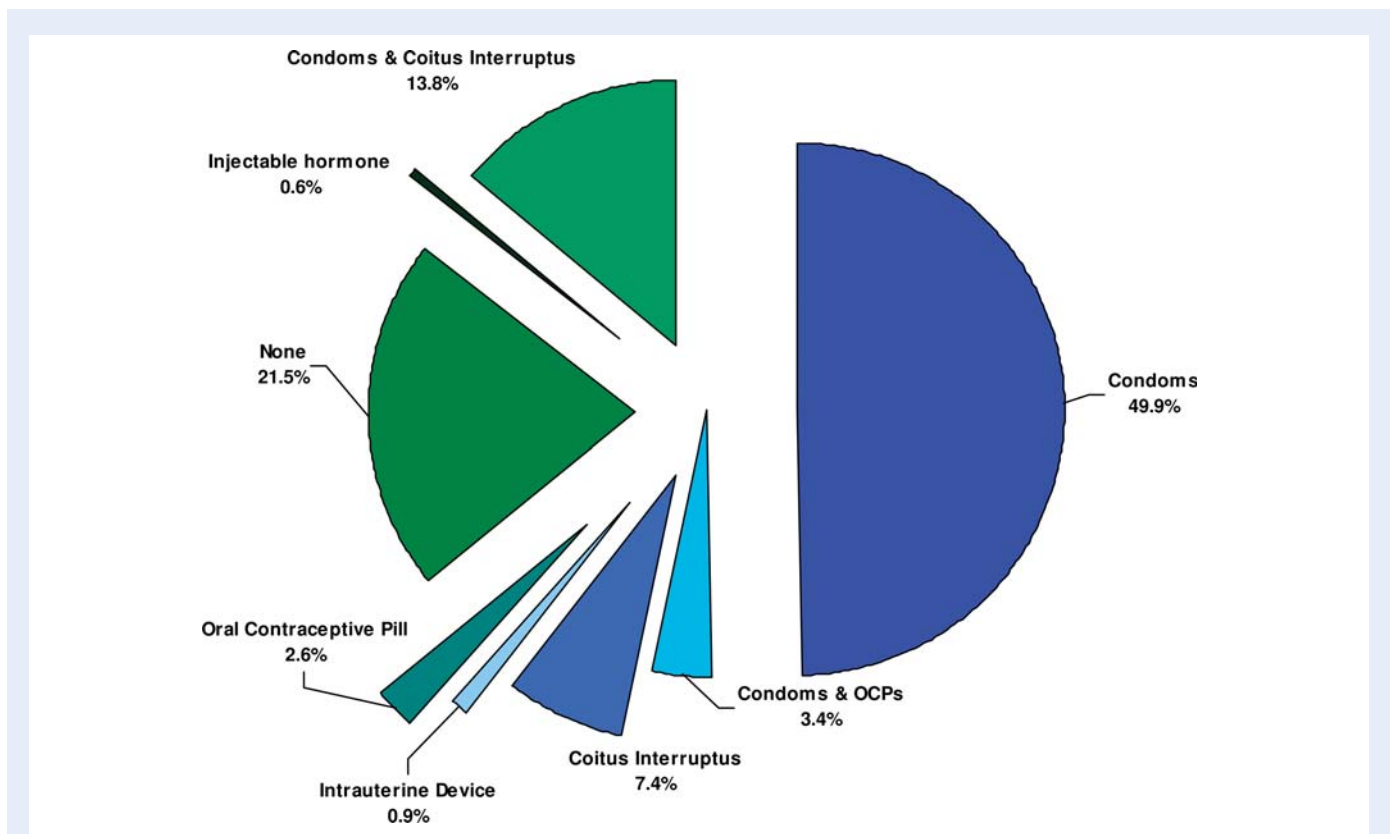
### Post-natal family planning

Most (77%, 277 of 360) women reported being sexually active at the time of enrolment. Sexual activity was significantly associated with marital status, with 90% (267 of 297) of married/cohabiting women sexually active versus 16% (10 of 63) of other women ( $\chi^2 = 160.1$ ,  $P < 0.001$ ), and with reported affordability of contraception, with 43% (32 of 74) of women reporting that they could not afford contraception being sexually active versus 85% (246 of 289) of women who could afford it ( $\chi^2 = 57.6$ ,  $P < 0.001$ ). Overall, 90% (328 of 365) women reported having received post-natal FP counselling, of whom the vast majority were counselled by a doctor (318 of 331, 96%) in the HIV/AIDS centre (236 of 330, 72%). Current post-natal FP methods reported at enrolment are presented in Fig. 2 for all women. Although over 20% of women overall reported no current contraception use, 80% of these (60 of 75) reported not being sexually active currently. Of the women reporting not being sexually active at enrolment, 45% (37 of 83) had not planned their most recent pregnancy, significantly more than in the sexually active group (16%, 45 of 277) ( $\chi^2 = 29.1$ ,  $P < 0.01$ ).

Condoms were the most common form of contraception, used by half of the women. A minority of women (<4%) reported using the OCP and condoms, although it is unclear whether this reflected concurrent or alternate use. We carried out logistic regression analyses to identify predictors of post-natal condom use among sexually active, married or cohabiting women. As women reporting condom use and *coitus interruptus* or condoms and OCPs could be in either the barrier or the non-barrier categories, two models were performed: the first included women reporting condom use alone or together with another contraceptive method in the barrier group and the second, stricter model included them in the non-barrier group. In univariable models, the following were not associated with using condoms post-natally ( $P > 0.10$ ): IDU history, age, education, history of pregnancy termination and bacterial STI; women who had disclosed their HIV status to their partner, those who planned their most recent pregnancy, those who had consistently used condoms in their most recent pregnancy, those receiving post-natal FP counselling, those with HSV-2 and those currently sexually active were significantly more likely to use barrier contraception, whereas women with an HIV-positive partner were significantly less likely to use condoms



**Figure 1** Previous reproductive history prior to most recent pregnancy (n = 331).



**Figure 2** Post-natal family planning methods (n = 349).

post-natally (Table II). In the adjusted models of post-natal condom use, the strongest factors associated with condom use were current sexual activity and region (Table II); consistent use of condoms in the most recent pregnancy was associated with a 2-fold increased likelihood of post-natal condom use, while women with HIV-positive

partners were significantly less likely to use condoms than women with HIV-negative partners (Table II).

Use of effective post-natal contraception was low (Fig. 2). The only factors predictive of use of these methods in univariable analysis were marital status, with 21% (14/67) single, divorced or widowed women

**Table II** Use of post-natal barrier contraception and associated factors.

|  | Unadjusted rate of barrier contraception (%) | Model 1 any condom use (n = 207) |        |                  |       | Unadjusted rate of strict barrier contraception (%) | Model 2 only condom use (n = 192) |       |
|--|--|----------------------------------|--------|------------------|-------|---|-----------------------------------|-------|
|  |  | OR                               | P      | AOR (95% CI)     | P     |   | AOR (95% CI)                      | P     |
| Partner HIV positive                   |  |                                  |        |                  |       |   |                                   |       |
| No                                     | 80/95 (84.2)                                 | 1.00                             |        | 1.00             |       | 63/95 (66.3)  | 1.00                              |       |
| Do not know/no partner                 | 50/110 (45.5)                                | 0.37                             | 0.03   | 0.57 (0.19–1.68) | 0.30  | 37/110 (33.6)                                       | 0.61 (0.26–1.46)                  | 0.27  |
| Yes                                    | 102/142 (71.8)                               | 0.48                             | 0.07   | 0.35 (0.13–0.95) | 0.04  | 72/142 (50.7)                                       | 0.46 (0.22–0.98)                  | 0.044 |
| Study site                             |  |                                  |        |                  |       |   |                                   |       |
| Odessa, Donetsk, Krivoy Rog            | 152/262 (58.0)                               | 1.00                             |        | 1.00             |       | 107/262 (40.8)                                      | 1.00                              |       |
| Kiev                                   | 82/87 (94.3)                                 | 8.50                             | 0.0006 | 6.89 (1.86–25.5) | 0.004 | 67/87 (77.0)  | 3.35 (1.53–7.32)                  | 0.003 |
| Timing of HIV diagnosis                |  |                                  |        |                  |       |   |                                   |       |
| Prior to this pregnancy                | 53/89 (59.6)                                 | 1.00                             |        | 1.00             |       | 38/89 (42.7)  | 1.00                              |       |
| During pregnancy/at delivery           | 143/202 (70.8)                               | 0.48                             | 0.049  | 0.72 (0.32–1.61) | 0.42  | 109/202 (54.0)                                      | 0.81 (0.41–1.60)                  | 0.54  |
| Condom use in most recent pregnancy    |  |                                  |        |                  |       |   |                                   |       |
| Inconsistent use                       | 106/187 (54.1)                               | 1.00                             |        | 1.00             |       | 74/187 (39.6)                                       | 1.00                              |       |
| Consistent use                         | 127/159 (79.9)                               | 3.02                             | 0.003  | 2.39 (1.06–5.40) | 0.035 | 99/159 (62.3)                                       | 1.88 (1.01–3.50)                  | 0.045 |
| Post-natal family planning counselling |  |                                  |        |                  |       |   |                                   |       |
| Not received                           | 14/34 (41.2)                                 | 1.00                             |        | 1.00             |       | 12/34 (35.3)  | 1.00                              |       |
| Received                               | 220/315 (69.8)                               | 2.95                             | 0.078  | 2.68 (0.69–10.4) | 0.15  | 162/315 (51.4)                                      | 1.05 (0.30–3.61)                  | 0.94  |
| HSV-2 coinfection                      |  |                                  |        |                  |       |   |                                   |       |
| No                                     | 127/208 (61.1)                               | 1.00                             |        | 1.00             |       | 88/208 (42.3)                                       | 1.00                              |       |
| Yes                                    | 56/71 (78.9)                                 | 2.31                             | 0.063  | 1.34 (0.47–3.78) | 0.58  | 41/71 (57.8)  | 0.86 (0.39–1.88)                  | 0.86  |

**Table III** Factors associated with no post-natal contraceptive use among married and cohabiting, sexually active women (n = 216).

|   | OR   | P      | AOR (95% CI)     | P     |
|---|------|--------|------------------|-------|
| Affordability of contraception          |      |        |                  |       |
| Affordable                              | 1.00 |        | 1.00             |       |
| Not affordable                          | 10.1 | <0.001 | 6.34 (1.73–23.2) | 0.005 |
| Study site                              |      |        |                  |       |
| Odessa, Donetsk, Krivoy Rog             | 1.00 |        | 1.00             |       |
| Kiev                                    | 0.16 | 0.08   | 0.17 (0.02–1.56) | 0.12  |
| Condom use during most recent pregnancy |      |        |                  |       |
| Consistent use                          | 1.00 |        | 1.00             |       |
| Inconsistent use                        | 8.09 | 0.007  | 7.25 (1.41–37.2) | 0.02  |
| Post-natal family planning counselling  |      |        |                  |       |
| Received                                | 1.00 |        | 1.00             |       |
| Not received                            | 4.99 | 0.013  | 3.99 (0.91–17.6) | 0.06  |

using effective contraception compared with 11% (33 of 303) of married or cohabiting women ( $\chi^2 = 4.9$ ,  $P = 0.03$ ) and study site. In logistic regression analysis including both variables, women living in Kiev had a 5-fold increased likelihood of being on effective contraception compared with other women (AOR 4.88 95% CI 2.49–9.57,

$P < 0.001$ ), while married or cohabiting women were 69% less likely to be using an effective contraceptive method (AOR 0.31 95% CI 0.15–0.66,  $P = 0.003$ ). Finally, we investigated factors associated with no post-natal use of contraception among married or cohabiting, sexually active women (Table III). In adjusted analysis, affordability of FP and condom use in the most recent pregnancy were significantly associated with contraceptive use, with receipt of post-natal FP counselling achieving borderline statistical significance.

## Discussion

We have described post-natal FP practices among HIV-positive child-bearing women in Ukraine. These women were predominantly young, married or cohabiting and at early stages of HIV disease. Around three quarters of women had planned their most recent pregnancy and two-thirds had not been aware of their HIV status before the pregnancy. Nearly half of women were using ineffective post-natal contraception, and one in five was using no contraception at all, although a relatively high proportion of this latter group reported not being currently sexually active.

The predominance of condom use for post-partum contraception in our study population likely reflects the dual protection that condoms provide against pregnancy and acquisition or transmission of HIV and other STIs. This is underscored by the 2–3-fold increased likelihood of condom use post-partum in women who used condoms during pregnancy and in those who had HIV-negative partners. The finding that more women in HIV-discordant couples used condoms

than those in concordant couples is consistent with other studies (Heard *et al.*, 2004). However, one in six married/cohabiting women in discordant partnerships were not using barrier methods at all. Several studies have reported that, in HIV discordant partnerships where the woman is infected, risk of onward transmission is sometimes perceived as negligible (Stevens and Galvao, 2007; Sanders, 2009) and, in one study, intercourse without barrier contraception was more common when the female rather than the male was infected (Bouhnik *et al.*, 2007). Transmission risk per sex act for female-to-male HIV transmission is estimated to range from 0.04% in high income settings to 0.38% in low income settings in the absence of antiretroviral therapy; furthermore, genital ulcers in either partner is estimated to increase infectivity 5-fold (Boily *et al.*, 2009). A quarter of women in our study had been recently diagnosed with at least one STI, and only 14% were on HAART, indicating the potential for onward transmission to HIV-negative partners. Previous research has indicated that many concordant couples do not perceive any advantage to using condoms (Heard *et al.*, 2004; Stanwood *et al.*, 2007), however in this study more than 50% of discordant couples used condoms.

In our study, 40% of women were using ineffective, unreliable post-natal contraception methods or nothing at all and risk future unplanned pregnancy. Although many women reporting no current use of FP methods were not sexually active, it is likely that many will resume sexual activity, raising questions on preparedness to use FP. Our finding that significantly more women who, at enrolment, were sexually inactive than active had not planned their most recent pregnancy suggests that they may be at increased risk of future unintended pregnancy. Time to resumption of sexual activity after childbirth is estimated to be 6–8 weeks in the general population in Europe (Vikhyaeva *et al.*, 2001; van Brummen *et al.*, 2006; Radestad *et al.*, 2008). In our study, 77% of women reported having resumed sexual activity at a median of 2 months post-partum. The likelihood of future unintended pregnancies in our study population is underscored by their reproductive histories, with a third having previous pregnancy terminations.

The reproductive and FP behaviours reported here need interpretation within the national context. FP provision and uptake have been low historically in the former Soviet Union, with high prevalence of traditional methods, and this has largely continued to date (Popov *et al.*, 1993; Perlman and McKee, 2009). However, a study in the Russian Federation indicated an increased use of barrier contraception, from 9% in 1994 to 21% in 2003, possibly reflecting HIV awareness (Perlman and McKee, 2009). In studies in Ukraine, 51% of nearly 300 sexually active, non-pregnant women had not used contraception in the previous month (Mogilevkina and Odland, 2003) and 20% of medical students had not used contraception at their most recent coitus (Mogilevkina *et al.*, 2001).

In the Ukraine, among the general population, costs of contraception are not met by the health system. In our study, the lack of post-natal contraception was strongly associated with affordability, despite the official policy of free provision of contraception to HIV-positive women, indicating that this policy is not effectively implemented. The strong association found between current sexual activity and affordability of contraception is noteworthy and requires further investigation. Our finding that women in Kiev were three times more likely to use condoms post-natally than women attending other sites reflects

more active promotion and greater availability of condoms in Kiev than in other sites; in Kiev, free condoms are available in a variety of places within the AIDS Centre, including the waiting room. There was good coverage of post-natal FP counselling among our study population, with only 10% of women not receiving counselling. Our results highlight the importance of such counselling, as women not receiving it were four times more likely not to be using any contraceptive method than women who did.

Contraceptive use is generally influenced by a large number of factors, including access to FP, social norms about contraception, acceptability of different methods to both the woman and her partner and desire for a pregnancy. FP decisions for couples where one or both partners are HIV-positive are complicated by risk of sexual transmission of HIV. Counselling on safe sex and FP should consider the couple and their life choices and a pragmatic approach may be the most effective. For example, in an HIV-concordant couple, if long-term condom use is unlikely, counselling could focus on the benefits of using condoms in subsequent pregnancies or encouraging STI testing and treatment of both partners. There is conflicting evidence regarding the impact of hormonal contraception on HIV disease progression (Stringer *et al.*, 2007; Stringer *et al.*, 2009a, b), although IUDs appear to be a safe and effective FP method for HIV-infected women (Stringer *et al.*, 2007); both methods were rarely used in our population.

The Glion Call to Action called for strengthening linkages between PMTCT and FP services (UNFPA and WHO, 2006), but prevention of unintended pregnancy has received substantially less attention than other components (Rutenberg and Baek, 2005; Delvaux and Nostlinger, 2007). In Ukraine, the main focus of the national PMTCT programme has been on antenatal HIV testing and provision of PMTCT interventions. The broader benefits of reducing unintended pregnancies in HIV-infected women extend beyond the prevention of new HIV infections in infants: women with access to FP services are able to decide on the number and spacing of their children, to avoid induced abortion (safe and unsafe) and reduce their own chances of acquiring STIs as well as limiting their potential for onward transmission to sexual partners.

There are several limitations to this observational study, which has potential for both measured and unmeasured confounding. Most data were collected in the post-natal period that may not reflect longer-term post-natal FP and sexual activity. Although we collected information on condom use in pregnancy, we had no data on sexual activity in pregnancy. The analyses presented use baseline data collected at enrolment and are thus cross-sectional; we are therefore unable to comment on whether significant variables identified in this observational study were causally related to FP outcomes and whether they remain significant over time. However, as this is an ongoing cohort, longitudinal examination of these relationships in the future will be possible, including estimates of incidence of planned and unplanned sequential pregnancies. Use of self-administered questionnaires prevented interviewer-related bias, but there may still have been potential for social desirability bias introduced by this methodology. Our study population is representative of HIV-infected childbearing women in Ukraine participating in a larger epidemiological study (Thorne *et al.*, 2009); however, caution should be taken in generalizing these results to populations of HIV-positive childbearing women in other settings. All the women in our cohort had completed their pregnancies

and thus our results may not apply to the HIV-positive pregnant population as a whole. In particular, the proportion of women whose most recent pregnancy was unplanned (23%) is likely to be lower than it would be for the entire pregnant, HIV-infected population, which would include women with unintended pregnancies who had pregnancy terminations.

## Conclusion

An unacceptably high proportion of our population of post-natal HIV-positive women was using ineffective or unreliable FP methods, or none, and thus will be at risk of future unintended pregnancy. Use of oral contraceptives, injectable contraceptives and IUDs was low. Although condoms were more likely to be used by those needing to use them most (i.e. discordant couples), our results indicate potential for onward heterosexual transmission to uninfected sexual partners in this population. Access to FP is an unmet need of many HIV-positive post-natal women in Ukraine, with lack of affordability a key barrier. Programme efforts should focus on implementing free provision of contraception and enhancing access to post-natal FP counselling.

## Authors' roles

C.T. and R.M. contributed to study concept and C.T., J.S., R.M., I.S. and T.P. contributed to study design. R.M., I.S., T.P., R.T., E.K., I.A., L.K. were involved in the acquisition of data. J.S. and C.T. drafted the manuscript and performed the statistical analyses. All authors contributed to the design and/or data collection for this study and all authors critically revised the manuscript for important intellectual content and read and approved the final manuscript.

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